



FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically designed in such combination. The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}) and the power (P_i or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o or V_{oc} or V_i), the current (I_o or I_{sc} or I_i) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The voltage U_o (or V_{oc} or V_i) of the associated apparatus has to be limited to the range of 14 V to 24 V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

- loop resistance R: 15...150 Ω/km
- inductance per unit length L_i: 0.4...1 mH/km
- capacitance per unit length C_i: 80...200 nF/km
- C = C_i line/line + C_i line/screen, if both lines are floating or
- C = C_i line/line + C_i line/screen, if the screen is connected to one line
- length of spur cable: ≤ 30 m
- length of trunk cable: ≤ 1 km
- length of splice: ≤ 1 m

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:
 R = 90...100 Ω
 C = 0...2.2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Intrinsically safe installation

1. Intrinsically safe (entitled), Class I, Div. 1, Groups A, B, C, D, Hazardous Location Installation.
1. FM approved apparatus must be installed in accordance with manufacturer instructions.
2. FM approved associated apparatus must meet the following requirements:
 U_o or V_{oc} or V_i ≤ U_i (V_{max}) and I_o or I_{sc} or I_i ≤ I_i (I_{max}) and P_o or P_{max} ≤ P_i (P_{max}).
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the National Electrical Code NFPA 70 and ANSI/ISA RP 12.06.01 (except chapter 5).
5. Multiple earthing of screen is allowed only, if high integrity equipotential system is realised between the points of bonding (see drawing No. 960373-1022 A).
6. Caution: Use only supply wires suitable for 5 K above surrounding temperature.
7. Warning: Substitution of components may impair intrinsic safety.
8. The polarity for connecting + (2) and - (1) is of no importance due to an internal rectifier.
9. In case of use of PTFE rod antenna (white), planar, parabolic, enamelled horn, type 244 or type 245 avoid electrostatic charge at the antenna (e.g. do not rub with dry cloth; do not install within the filling curtain).
10. The surge protection device (OVP) fulfils the requirements of IEC 60079-14 clause 12.3.
11. Apparatus with faucet: In case of disconnection of Micropilot M from the faucet (e.g. for maintenance) we recommend to secure resp. to close the faucet e.g. with an additional blind flange. The responsibility for applicability of the arrangement behaviours exclusive the operator.

Division 2 and Zone 2 installation

1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
 Intrinsic safety barrier not required. Max. supply voltage 33 V. For T-code see table.
2. Nonincendive field wiring installation.
 The Nonincendive Field Wiring Circuit Concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus or associated apparatus not specifically examined in combination as a system using any of the wiring methods permitted for unclassified locations, when V_{max} ≥ V_{oc} or V_i, C_a ≥ C_i + C_{able}, L_a ≥ L_i + L_{able}.
 Transmitter non incandive field wiring parameters for these current controlled circuit are as follows:
 V_{max} = 33 V; C_i ≤ 5 nF; L_i ≤ 10 µH; I_{max} = see note 3.
 For these current controlled circuit, the parameter I_{max} is not required and need not to be aligned with parameter I_{sc} and I_t of the associated nonincendive field wiring apparatus or associated apparatus.
4. Warning: Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous.
 Warning: Substitution of components may impair suitability for Class I, Division 2.

Class II, III installation

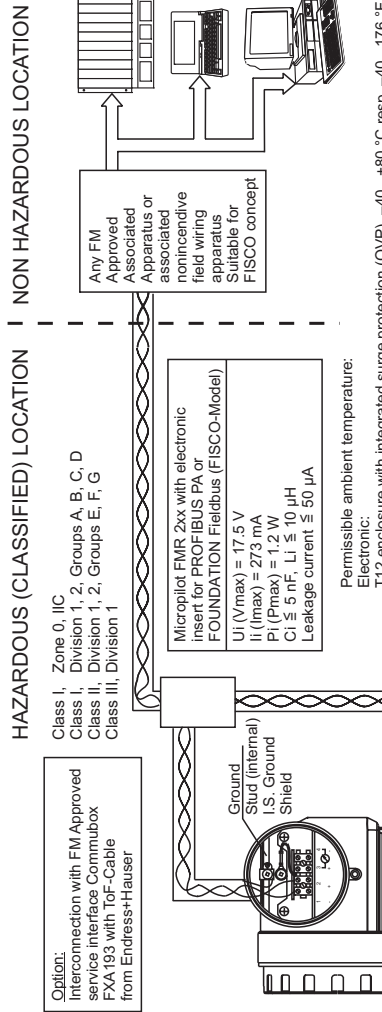
1. Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
2. Use a dust tight seal at the conduit entry.

Functional ratings:

These ratings do not supersede Hazardous Locations values U_{nom} ≤ 33 V, I_{nom} = 15 mA.

Area of application:

The compact instruments are suitable for use in areas subject to explosion caused by gases, vapours or mists.



Type	Type of antennas	Operation temperature ¹⁾
FMR230 - ..F	Horn antenna with PTFE-Korund feeder (Tanial gasket)	-40 °C/-40 °F to +200 °C/392 °F
-..G	HT antenna (Graphite gasket)	-40 °C/-40 °F to +350 °C/662 °F
-..H	HT antenna with scavange connection (extended temperature)	-60 °C/-76 °F to +400 °C/752 °F
-..L	HT (high temperature)	depends on type
-..M	HT (high temperature)	-60 °C/-76 °F to +280 °C/536 °F
FMR231 -	Rod antenna PPS	-20 °C/-4 °F to +120 °C/250 °F
	Rod antenna PTFE	-40 °C/-40 °F to +150 °C/300 °F
	Rod antenna PTFE cladided	-40 °C/-40 °F to +150 °C/300 °F
	Sanitary (process connection)	-40 °C/-40 °F to +150 °C/300 °F
	PVDF (process connection)	-20 °C/-4 °F to +80 °C/176 °F
FMR232 -	Planar antenna	-40 °C/-40 °F to +150 °C/300 °F
FMR233 -	Parabolic antenna	-40 °C/-40 °F to +200 °C/392 °F
FMR240 -	> 20 GHz horn antenna	-40 °C/-40 °F to +150 °C/300 °F
	Wave guide antenna	-60 °C/-76 °F to +200 °C/392 °F
FMR244 -	Horn compact, extended, special edition	-40 °C/-40 °F to +130 °C/266 °F
	Compact antenna (PTFE capsuled)	-40 °C/-40 °F to +80 °C/176 °F
FMR245 -	Compact antenna (types 3, 4)	-40 °C/-40 °F to +150 °C/302 °F
	DN50 + DN80 (types B, C, F, G)	-40 °C/-40 °F to +200 °C/392 °F

¹⁾ Note: take care to specific temperature ranges of antenna versions

Temperature class with/without display VU331	Permissible max. ambient temperature of the electronic compartment (Ia) (enclosure T12 (OVP) Ex I with internal surge protection device)									
	FMR230 - ..EV/K/D/H	FMR230 - ..L	FMR230 - ..M	FMR230 - ..F/G	FMR231	FMR232	FMR233	FMR240 Wave Guide	FMR244	FMR245
+ 80 °C	+55/60 °C	+60/65 °C	+60/65 °C	+50/45 °C	+55/60 °C	+55/60 °C	+55/60 °C	+60/65 °C	+55/60 °C	+60/65 °C
+ 95 °C	+70/65 °C	+70/65 °C	+70/65 °C	+65/60 °C	+70/65 °C	+70/65 °C	+70/65 °C	+70/65 °C	+70/65 °C	+70/65 °C
+ 130 °C	+75 °C	+75 °C	+75 °C	+65 °C	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C
+ 150 °C	+75 °C	+75 °C	+75 °C	+65 °C	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C
+ 195 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
+ 250 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
+ 280 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
+ 290 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
+ 350 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
+ 400 °C	+80 °C	+80 °C	+80 °C	+70 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C

Note: the applicable temperature of antenna must be within their specified limits. Tx (functional) means limited through type of antenna; T6 and T5 requires for FF electronic enlarged derating; for ambient; 1st number = PA electronic insert; 2nd number = FF electronic insert e.g. +60/55 °C expression means: Apparatus with PA electronic insert max. ambient at housing = +60 °C; Apparatus with FF electronic insert max. ambient at housing = +55 °C.



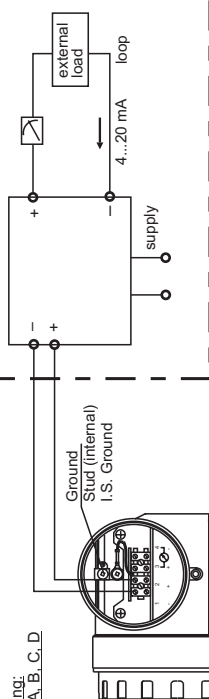
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HAZARDOUS LOCATION

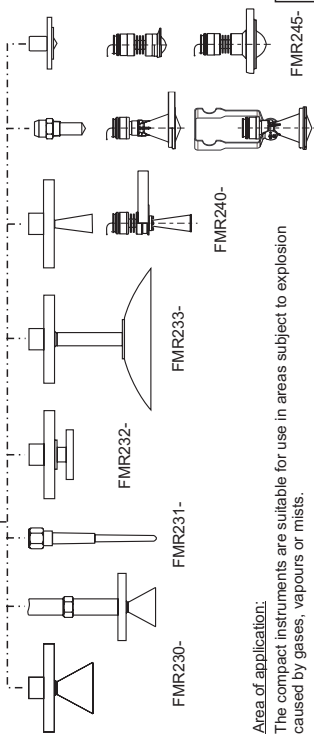
Class I, Div. 1, 2, Groups A, B, C, D
Class I, Zone 0, IIC
Class II, Div. 1, 2, Groups E, F, G
Class III

T12-OVP Housing:
IS / I, II, III / 1, A, B, C, D

Any FM approved associated apparatus or associated nonincendive field wiring apparatus



Option:
Interconnection with FM Approved Service Interface Commubox FXA193 with ToF-Cable from Endress+Hauser



Area of application:

The compact instruments are suitable for use in areas subject to explosion caused by gases, vapours or mists.

Permissible ambient temperature:

Electronic:
T12 enclosure with integrated surge protection (OVP) -40...+80 °C, resp. -40...+176 °F

Type	Type of antennas	Operation temperature ¹⁾
FMR230 - -F -G	Horn antenna with PTFE-Korund feeder HT antenna (Tantal gasket) HT antenna (Graphite gasket) Horn antenna with scavange connection XT (extended temperature) HT (high temperature)	-40 °C/-40 °F to +200 °C/392 °F -40 °C/-40 °F to +350 °C/662 °F -60 °C/-76 °F to +400 °C/752 °F depends on type -60 °C/-76 °F to +280 °C/536 °F -60 °C/-76 °F to +400 °C/752 °F
FMR231 -	Rod antenna PPS Rod antenna PTFE Rod antenna PTFE cladided Sanitary (process connection) PVDF (process connection)	-20 °C/-4 °F to +120 °C/250 °F -40 °C/-40 °F to +150 °C/300 °F -40 °C/-40 °F to +150 °C/300 °F -40 °C/-40 °F to +150 °C/300 °F -20 °C/-4 °F to +80 °C/176 °F
FMR232 -	Planar antenna	-40 °C/-40 °F to +150 °C/300 °F
FMR233 -	Parabolic antenna	-40 °C/-40 °F to +200 °C/392 °F
FMR240 -	> 20 GHz horn antenna Wave guide antenna Horn compact, extended, special edition	-40 °C/-40 °F to +150 °C/300 °F -60 °C/-76 °F to +200 °C/392 °F -40 °C/-40 °F to +150 °C/300 °F
FMR244 -	Compact antenna (PTFE capsuled) 80 mm ³ , PP cladided (type 4)	-40 °C/-40 °F to +130 °C/266 °F -40 °C/-40 °F to +80 °C/176 °F
FMR245 -	Compact antenna (types 3, 4) DN50 + DN80 (types B, C, F, G)	-40 °C/-40 °F to +150 °C/302 °F -40 °C/-40 °F to +200 °C/392 °F

¹⁾ Note: take care to specific temperature ranges of antenna versions

For installation acc. -FISCO- Concept see Control dwg. part 960402-1073

Functional ratings:

These ratings do not supersede Hazardous Locations values Unom ≤ 33 V, Inom = 15 mA.

Notes:

Intrinsically safe installation

Intrinsically safe (entity), Class I, Div. 1, Groups A, B, C, D, Hazardous Location Installation.

- Control room equipment may not use or generate over 250 Vrms.
- Use FM Approved Entity-Approved intrinsic safety barrier with Voc or Vi ≤ Vmax, Isc or It ≤ Imax, Ca ≥ Ci + Ccable, La ≥ Li + Lcable barrier must be capable of delivering more than defined value (Pmax) to a matched load.
Transmitter entity parameters are as follows:
Vmax = 17.5 V or 24 V, Imax = 273 mA or 250 mA, Ci ≤ 5 nF, Li ≤ 10 µH, Pmax = 1.2 W or 1.2 W.

3. Installation should be in accordance with ANSI / ISA RP12.06.01.

Installation of intrinsically safe systems for Hazardous (Classified) locations and the National Electrical code (ANSI / NFPA 70).

4. Warning: Substitution of components may impair intrinsic safety.

5. Intrinsic safety barrier manufacturer's installation drawing must be followed when installing this equipment.

The configuration of the intrinsic safety barrier(s) must be FM Approved.

6. Use supply wires suitable for 5 K above surrounding ambient.

7. In case of use of PTFE rod antenna (white), planar, parabolic, enamelled horn, type 244 or type 245 avoid electrostatic charge at the antenna; (e.g. do not rub with dry cloth; do not install within the filling curtain)

8. The surge protection device (OVP) fulfills the requirements of IEC 60079-14 clause 12.3.

9. Apparatus with faucet: In case of disconnection of MicroPilot M from the faucet (e.g. for maintenance) we recommend to secure resp. to close the faucet e.g. with an additional blind flange. The responsibility for applicability of the arrangement behooves exclusive the operator.

Division 2 and Zone 2 Installation

Nonincendive, Class I, Div. 2, Groups A, B, C, D, Hazardous Location Installation.

- Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510. Intrinsic safety barrier not required. Max. supply voltage 33 V. For T-code see table.
- Nonincendive field wiring installation
The Nonincendive Field Wiring Circuit Concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus or associated apparatus not specifically examined in combination as a system using any of the wiring methods permitted for unclassified locations, when Vmax ≥ Voc or Vi, Ca ≥ Ci + Ccable, La ≥ Li + Lcable.

Transmitter non incendive field wiring parameters for these current controlled circuit are as follows:

Vmax = 33 V; Ci ≤ 5 nF; Li ≤ 10 µH; Imax = see note 3.

3. For these current controlled circuit, the parameter Imax is not required and need not to be aligned with parameter Isc and It of the associated nonincendive field wiring apparatus or associated apparatus.

4. Warning: Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous.

Warning: Substitution of components may impair suitability for Class I, Division 2.

Class II, III Installation

DIP for Class II and III, Div. 1, Groups E, F, G, Hazardous Location Installation.

- Installation shall be in accordance with NEC using threaded conduits or other wiring methods in accordance with Article 500 through Article 510.
- Use a dust tight seal at the conduit entry.

Temperature class with/without display VU331	Permissible max. ambient temperature of the electronic compartment (Ta) (enclosure T12 (OVP) Ex I with internal surge protection device)										
	FMR230 - ..V/K/D/H	FMR230 - ..L	FMR230 - ..M	FMR230 - ..F/G	FMR231	FMR232	FMR233	FMR240	FMR240 Wave Guide	FMR244	FMR245
T6	+80 °C	+55/50 °C	+60/55 °C	+60/55 °C	+50/45 °C	+55/50 °C	+55/50 °C	+55/50 °C	+60/55 °C	+55/50 °C	+55/50 °C
T5	+95 °C	+70/65 °C	+70/65 °C	+70/65 °C	+65/60 °C	+70/65 °C	+70/65 °C	+70/65 °C	+60/55 °C	+60/55 °C	+60/55 °C
T4	+130 °C	+75 °C	+75 °C	+75/70 °C	+75/70 °C	+75/70 °C	+75/70 °C	+75/70 °C	+75/70 °C	+75/70 °C	+75/70 °C
T3C (functional)	+150 °C	+75 °C	+75 °C	+75 °C	+85 °C	+70 °C	+70 °C	+70 °C	+75 °C	+75 °C	+70 °C
T3	+195 °C	+85 °C	+85 °C	+85 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C	+80 °C
T2B (functional)	+250 °C	+60 °C	+60 °C	+60 °C	+70 °C	not allowed	+60 °C	not allowed	+75 °C	not allowed	+65 °C
T2	+230 °C	not allowed	+75 °C	+75 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2	+230 °C	not allowed	+80 °C	+80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T2	+200 °C	not allowed	+75 °C	+75 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+350 °C	not allowed	+80 °C	+80 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+400 °C	not allowed	+70 °C	+70 °C	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed	not allowed
T1 (functional)	+80 °C	allowed	+80 °C	+80 °C	allowed	allowed	allowed	allowed	allowed	allowed	allowed

Note: the applicable temperature of antenna must be within their specified limits; Tx (functional) means limited through type of antenna;

T6 and T5 requires for FF electronic enlarged derating; for ambient; 1st number = PA electronic insert; 2nd number = FF electronic insert

e.g. +60/55 °C expression means: Apparatus with PA electronic insert max. ambient at housing = +60 °C;

Apparatus with FF electronic insert max. ambient at housing = +55 °C